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Air Force awarded patents to detect wiring problems

by Fran Crumb, Information Directorate

ROME, N.Y. — The U.S. Patent and Trademark Office has issued two patents to the Air Force Research Laboratory (AFRL) for technologies that will help preempt catastrophic aircraft system failures by detecting wiring problems before they can cause a failure.

"Aircraft wiring systems are known to be a large contributor to aircraft problems," said Frank H. Born of the AFRL Information Directorate. "Cable chafing and connector corrosion are both age-related and, as such, will continue to cause more problems as the air fleet ages."

AFRL has received patents on two techniques that promise to help detect these potentially life-threatening situations before they can cause system failures. The patent for "Detection of Conduit Chafing" utilizes a simple sensing technique to monitor for chafing in electrical and hydraulic conduits that can lead to disastrous mid-air failures.

"Our technique basically involves wrapping a fiber optic cable or piece of wire around the conduit you are monitoring," said Born, who applied for the patent along with Dr. Roy Stratton and Capt. Raymond Harris. "When the sensor breaks or short-circuits, you know you have dangerous chafing."

Stratton retired from government service last March. Harris completed his Air Force duty subsequent to the patent filing in 1999.

The technology is expected to be of prime interest to aircraft manufacturers concerned with chafing problems involving electrical systems in several models; however, it can also be applied to hydraulic or fuel lines where rupture or bursting can cause system failures and damage to surrounding materials.

The AFRL patent has been licensed to Kildeer Mountain Manufacturing Co. of Kildeer, N.D., which has teamed with United Airlines and obtained a Federal Aviation Administration contract to develop a prototype and possibly flight-test the chafing apparatus for high-risk cables on a Boeing 737 aircraft.

A second patent, issued to Born and personnel from SEMTAS Corp. of Annandale, Va., addresses the problem of corrosion on electrical connectors. In many environments, corrosion on electrical connectors is probably the leading cause of system malfunctions. Identification of degraded connector performance due to corrosion is difficult because of the inter mittent nature of many connector-caused system failures. Corroded electrical contacts are also tempo rarily wiped clean of corrosion on critical pin and sleeve surfaces when connectors are manually separated for inspection.

"The SEMTAS test instrument can detect the presence of significant corrosion on connectors prior to 'un-mating' them," said Born. "The technique injects a test signal through the cable insulation and records out the signal reflected from the connector contacts. The reflected signal will indicate the extent to which corrosion is affecting the transmission of the electrical signals across the connector junctions."

"We expect this technology will be commercialized, since it has applications as a tester for cables and connectors throughout the transportation industry for any system subject to corrosion," said Born. "The technology haspotential applications in identifying hidden electronic corrosion in automobiles, trains, subway and shipboard systems."

AFRL interest in chafing and corrosion detection began a decade ago and peaked after the National Transportation Safety Board (NTSB) cited the possibility that TWA Flight 800's center fuel tank exploded on July 17, 1996, due to an electrical short circuit. @